Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381

October 22, 2018

10 CFR 50.73

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Watts Bar Nuclear Plant, Unit 2
Facility Operating License No. NPF-96
NRC Docket No. 50-391

Subject: **Licensee Event Report 391/2018-005-00, Automatic Reactor Trip Due to Turbine Control System Card Failure and Throttle Valve Closure**

This submittal provides Licensee Event Report (LER) 391/2018-005-00. This LER provides details concerning a plant trip as a result of a control system throttle valve manual up/down counter card failure. This condition is being reported in accordance with 10 CFR 50.73(a)(2)(iv)(A) as an automatic actuation of the Reactor Protection System and the Auxiliary Feedwater Systems.

There are no new regulatory commitments contained in this letter. Please direct any questions concerning this matter to Kim Hulvey, WBN Licensing Manager, at (423) 365-7720.

Respectfully,

Paul Simmons
Site Vice President
Watts Bar Nuclear Plant

Enclosure
cc: See Page 2

cc (Enclosure):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Watts Bar Nuclear Plant

NRC FORM 366 (04-2018) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 03/31/2020

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001,or by e-mail to Infocollects. Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

1. Facility Name	2. Docket Number	3. Page
Watts Bar Nuclear Plant, Unit 2	05000391	1 OF 5

4. Title

Automatic Reactor Trip Due to Turbine Control System Card Failure and Throttle Valve Closure

5. Event Date			6. LER Number			7. Report Date			8. Other Facilities Involved	
Month	Day	Year	Year	Sequential Number	Rev No.	Month	Day	Year	Facility Name	Docket Number
									NA	05000
08	22	2018	2018	- 005	- 00	10	22	2018	Facility Name: NA	Docket Number: 05000

9. Operating Mode	11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: *(Check all that apply)*			
1	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
10. Power Level	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
100	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(i)
	☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(ii)
		☐ 50.73(a)(2)(i)(C)	☐ OTHER Specify in Abstract below or in NRC Form 366A	

12. Licensee Contact for this LER

Licensee Contact	Telephone Number (Include Area Code)
Dean Baker, Licensing Engineer	(423) 452-4589

13. Complete One Line for each Component Failure Described in this Report

Cause	System	Component	Manufacturer	Reportable to ICES	Cause	System	Component	Manufacturer	Reportable to ICES
B	IT	CNV	V-Infinity	Yes					

14. Supplemental Report Expected	15. Expected Submission Date	Month	Day	Year
☐ Yes (If yes, complete 15. Expected Submission Date) ☒ No		N/A	N/A	N/A

Abstract (Limit to 1400 spaces, i.e., approximately 14 single-spaced typewritten lines)

On August 22, 2018, at 0943 Eastern Daylight Time (EDT), the Watts Bar Nuclear Plant (WBN) Unit 2 reactor automatically tripped while operating at 100 percent power when operators changed the turbine control system from Operator Auto to Turbine Manual. All control and shutdown bank rods inserted properly in response to the reactor trip. All safety systems including the Auxiliary Feedwater (AFW) System actuated as expected. The reactor automatically tripped with a follow-on turbine trip in response to throttle valve closure. Throttle valve closure was caused by a turbine control system throttle valve manual up/down (U/D) counter card failure.

The card failure resulted in the closure of throttle valves which caused an initiation of a reactor trip with a follow-on turbine trip. Initial corrective actions included replacing the failed card. The main turbine analog electro-hydraulic (AEH) control system is scheduled to be replaced with a modern fault tolerant digital turbine control system. Installation is scheduled for the Unit 2 Cycle 2 refueling outage in April 2019.

This event is being reported in accordance with 10 CFR 50.73(a)(2)(iv)(A), as an automatic actuation of the Reactor Protection System (RPS) and the AFW system.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Watts Bar Nuclear Plant, Unit 2	05000391	2018	- 005	- 00

NARRATIVE

I. Plant Operating Conditions Before the Event

Watts Bar Nuclear Plant (WBN), Unit 2, was in Mode 1 at 100 percent rated thermal power.

II. Description of Event

A. Event Summary

At 0943 Eastern Daylight Time (EDT) on August 22, 2018, WBN Unit 2 experienced an automatic reactor trip when operators changed the turbine control system from Operator Auto to Turbine Manual. All control and shutdown bank rods inserted properly in response to the automatic reactor trip. All safety systems including Auxiliary Feedwater (AFW) {EIIS:BA} actuated in response to the trip, as expected. The reactor automatically tripped with a follow-on turbine trip in response to throttle valve closure. Throttle valve closure was caused by a turbine control system throttle valve manual up/down (U/D) counter card failure {EIIS:CBD} in the Analog Electro-Hydraulic (AEH) turbine controls {EIIS:TG}.

This event is being reported in accordance with 10 CFR 50.73(a)(2)(iv)(A), as an automatic actuation of the Reactor Protection System (RPS) and the AFW system.

B. Status of structures, components, or systems that were inoperable at the start of the event and that contributed to the event

No inoperable systems contributed to this event.

C. Dates and approximate times of occurrences

Date	Time (EDT)	Event
08/22/18	0943	Placed Unit 2 turbine controls in manual in accordance with 2-GO-4, the Unit 2 reactor and turbine tripped. Operations personnel entered procedure 2-E-0, Reactor Trip or Safety Injection
08/22/18	0945	Transitioned to 2-ES-0.1, Reactor Trip Response
08/22/18	1010	Transitioned to 2-GO-5, Unit Shutdown from 30 percent Reactor Power to Hot Standby.
08/22/18	1100	Initial field walkdown identified an U/D counter card with no indication.
08/22/18	1123	Event Notification 53557 made to the Nuclear Regulatory Commission (NRC)

NARRATIVE

D. Manufacturer and model number of each component that failed during the event

Throttle valve closure was caused by a turbine control system throttle valve manual U/D counter card (Siemens part number 1B51049-101) failure. Specifically, the DC/DC +15/+5 converter {EIIS:CNV} on the card had failed. The DC/DC converters were made by V-Infinity, model PTK10-Q24-S5.

E. Other systems or secondary functions affected

Secondary systems functioned as expected

F. Method of discovery of each component or system failure or procedural error

The turbine control system throttle valve manual U/D counter card failure was identified after the plant trip as part of troubleshooting.

G. Failure mode, mechanism, and effect of each failed component

The DC/DC +15/+5 converter on the turbine control system throttle valve manual U/D counter card failed. This failure caused all four throttle valves to close, which initiated a reactor trip with a follow-on turbine trip.

H. Operator actions

Operations personnel promptly stabilized the plant following the plant trip.

I. Automatically and manually initiated safety system responses

Reactor trip was in response to throttle valve closure. Safety systems responded as expected, including reactor trip and automatic initiation of AFW.

III. Cause of the Event

A. Cause of each component or system failure or personnel error

The troubleshooting performed following the event identified the cause of the trip to be a turbine control system throttle valve manual U/D counter card failure. Specifically, the DC/DC +15/+5 converter on the card had failed.

B. Cause(s) and circumstances for each human performance related root cause

A review of the event identified opportunities where management of risk-based decisions could be improved. These opportunities for improvement do not represent human performance root causes.

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Watts Bar Nuclear Plant, Unit 2	05000391	2018	- 005	- 00

NARRATIVE

IV. Analysis of the Event

On August 22, 2018, while preparing to lower turbine load to remove the Unit 2 Standby Main Feed Pump (SBMFP) from service, operators placed the AEH controls in Turbine Manual. Within seconds of placing the system in manual, high pressure turbine throttle valves closed which resulted in a Reactor Trip with a follow-on Turbine Trip. Following the trip, operators entered 2-E-0, Reactor Trip or Safety Injection, and subsequently transitioned to 2-ES-0.1, Reactor Trip Response, to place Unit 2 in Mode 3 using procedure 2-GO-5, Unit Shutdown from 30 percent Reactor Power to Hot Standby. This reactor trip is considered uncomplicated.

V. Assessment of Safety Consequences

The automatic Unit 2 reactor trip that occurred on August 22, 2018 is generally comparable to the Updated Final Safety Analysis Report (UFSAR) description of the Loss of External Electrical Load and/or Turbine Trip described in UFSAR Section 15.2.7. A probabilistic risk analysis performed for this event indicates the conditional core damage probability from this event is small.

A. Availability of systems or components that could have performed the same function as the components and systems that failed during the event

The turbine controls system is not safety related. The failure of the turbine control system throttle valve manual U/D counter card resulted in a unit trip, but otherwise did not impact any plant safety functions.

B. For events that occurred when the reactor was shut down, availability of systems or components needed to shut down the reactor and maintain safe shutdown conditions, remove residual heat, control the release of radioactive material, or mitigate the consequences of an accident

Not applicable.

C. For failure that rendered a train of a safety system inoperable, an estimate of the elapsed time from the discovery of the failure until the train was returned to service

Not applicable.

VI. Corrective Actions

This condition was entered into the TVA Corrective Action Program (CAP) and is being tracked under Condition Report (CR) 1441438.

NARRATIVE

A. Immediate Corrective Actions

Operations personnel promptly stabilized the plant in Mode 3. A field walkdown of the turbine control cards identified the throttle valve manual U/D counter card with no light indications, indicating it had lost power. Troubleshooting concluded that the turbine control system throttle valve manual U/D counter card had failed which was the cause of this event. The failed card was replaced with a card containing a Lambda DC/DC converter

B. Corrective Actions to Prevent Recurrence or to reduce probability of similar events occurring in the future

To reduce the probability of a similar event occurring, three additional counter cards (setter, reference, and governor valve manual) with V-Infinity DC/DC power converters were replaced with cards having Lambda converters.

The main turbine AEH control system is scheduled to be replaced with a modern fault tolerant digital turbine control system. Installation is scheduled for the Unit 2 Cycle 2 refueling outage in April 2019. Until the digital electro-hydraulic turbine control system is installed, a monitoring plan has been established that will be used when maneuvering the main turbine from Auto to Manual. The plan will identify a failed counter card prior to shifting to Manual.

Corrective actions to improve risk management are being performed under Root Cause Analysis (RCA) for CR 1415482, Unplanned Plant Trips since Commercial Operation.

VII. Previous Similar Events at the Same Site

LER 390/2016-004-00 describes a Unit 1 trip that occurred on March 22, 2016 as a result of a turbine control system VPL U/D counter card failure, specifically the DC/DC converter on the card. The VPL counter card is the same part number as the turbine control system throttle valve manual U/D counter card, which failed on August 22, 2018; however, there was no trend of failure at the time.

VIII. Additional Information

There is no additional information.

IX. Commitments

There are no new commitments.